TABLE 4
Summary Catalog of Lithic Artifacts - Area A

	Jasper	Quartz	Quartzite	Chert	Chalcedony	Total
Flakes	10,235(40)	213(17)	21(4)	26(5)	2	10,497(66)
Cores	12(3)	4(2)	0	0	0	16(5)
Utilized flakes	7	0	0	0	0	7
Flake tools	0	1(1)	0	1(1)	0	2(2)
Miscellaneous stone tools	1	0	0	0	0	1
Early stage bifaces	12(3)	0	0	0	1(1)	13(4)
Late stage bifaces	18	7	1	1	0	27
Projectile points	9	4	0	0	0	13
Total	10,294(46)	229(20)	22(4)	28(6)	3(1)	10,576(77)

KEY: ( ) = cortex

EXCAVATION RESULTS AND INTERPRETATIONS - AREA A

Area A is located on the easternmost end of the site and was subjected to extensive block excavations (Figures 7 and 9; Plates 1 and 5). Table 4 shows a summary catalog of the lithic artifacts. In addition to the lithic artifacts, 190 ceramic sherds were recovered.

Stratigraphy and Site Context

Figure 12 and Plate 6 show the natural stratigraphic profile of the north wall of Area A. The top of the profile consists of a dark brown, recent humus soil (Horizon I) which extends to a depth of 5-10 cm. Horizons II and III are silty sands which are yellow/brown in color. They are located immediately beneath Horizon I although Horizon III is not continuous across the profile (Figure 12). Horizon II varies between 15 cm and 20 cm in depth and Horizon III varies between 15 cm and 35 cm in depth. Horizons IV - VIII are iron rich sands and clays that are much coarser in texture than any of the overlying horizons. Pebbles, gravels and iron concretions are common throughout these horizons which are up to 30 cm thick and extend to a depth of 75 cm below the modern ground surface. Horizon IX was identified in a deep test unit and consists of a gray-brown, thick clay soil unlike any of the overlying soils. Horizon IX was encountered at a depth of approximately 1 m below the modern ground surface and its bottom limits are unknown. In sum, the basic soil profile of Area A consists of four parts: 1) a modern humus soil (Horizon I), 2) yellow-brown silty sands (Horizons II and III), 3) a series of orange-brown sands with considerable iron concretions and pebbles, and 4) a gray thick clay soil.

The geological investigation of the site (Appendix I) indicated that most of the stratigraphic sequence of soils (Horizons IV-IX) dated from the Pleistocene Period and were sub-units of the Columbia Formation (Jordan 1964). The larger profiles exposed during the renewed excavations confirm this observation. The large amounts of translocated irons and clay minerals of these horizons are indicative of long periods of pedogenic stability and great age, at least more than 12,000 years. The appearance of pebbles and gravels through all of these horizons across Area A is also typical of Pleistocene Columbia Formation deposits. The age of Horizons II and III is more problematic and can best be determined by looking at the vertical distribution of artifacts through the profile at the site.

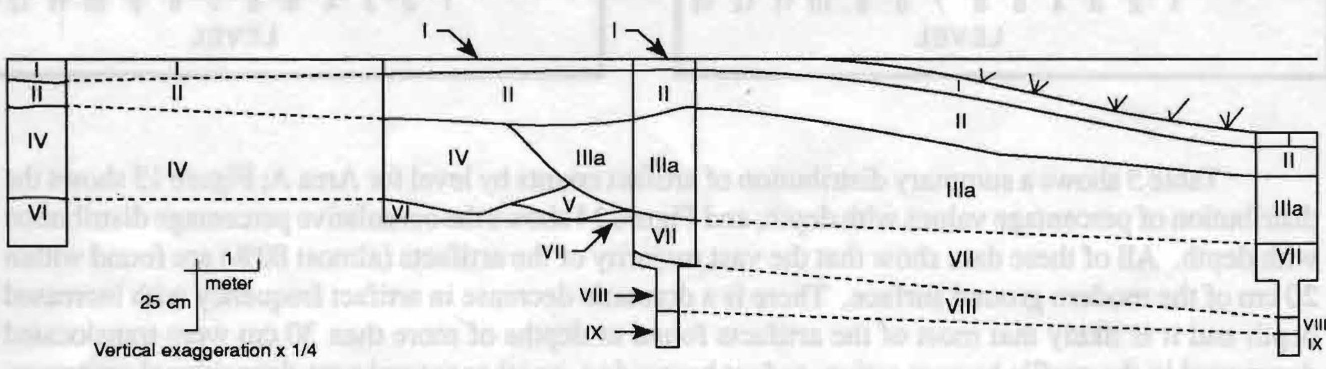
PLATE 6

North Wall Profile--Area A

I - Dark brown-black sandy loam (humus) II - Dark yellow-brown sandy silt IIIa - Yellow-brown silty sand

FIGURE 12

North Wall Profile--Area A



I - Dark brown/black sandy loam (humus)
II - Dark yellow-brown sandy silt
IIIa - Yellow-brown silty sand
IV - Orange-brown silty sand
V - Orange-brown silty sand with large sand granules
VI - Orange sand with large sand granules
VII - Orange sand with Pleistocene gravels and iron stains
VIII - Orange clay with gravels
IX - Gray-brown clay

TABLE 5

Summary Distribution of Total Artifact Counts by Level - Area A

	Level												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Count	2,758	2,293	2,180	1,376	892	626	334	233	126	33	19	10	1
Percent	25	21	20	13	8	6	3	2	1	<1	<1	<1	<1
Cumulative percent	25	46	66	79	87	93	96	98	99	100	100	100	100

FIGURE 13

Artifact Frequency with Depth-- Area A

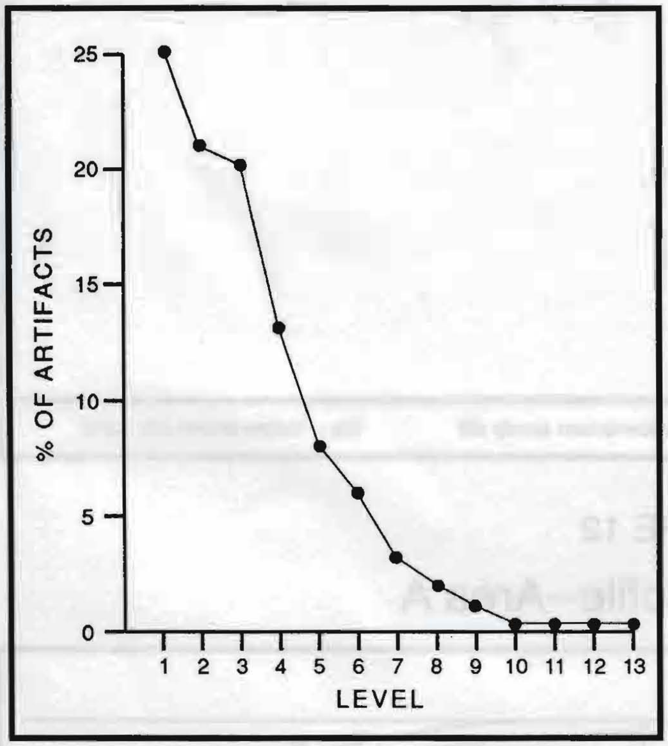


FIGURE 14

Cumulative Percent of Total Artifacts with Depth-- Area A

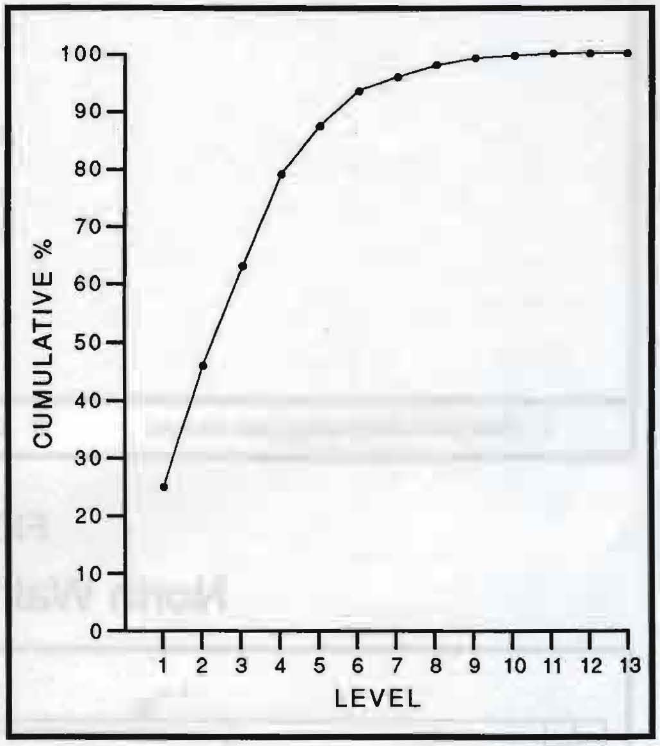
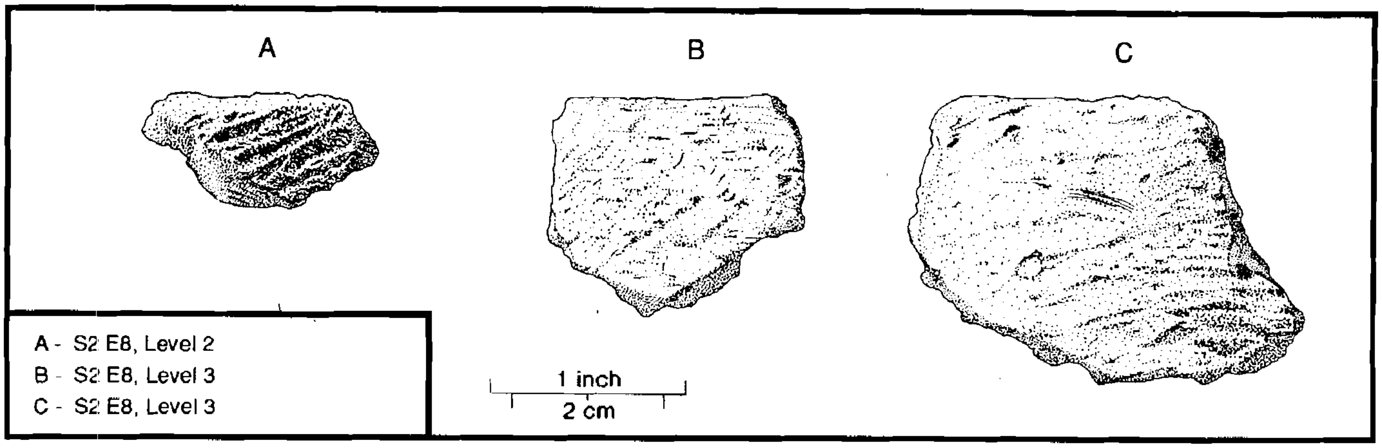


Table 5 shows a summary distribution of artifact counts by level for Area A; Figure 13 shows the distribution of percentage values with depth; and Figure 14 shows the cumulative percentage distribution with depth. All of these data show that the vast majority of the artifacts (almost 80%) are found within 20 cm of the modern ground surface. There is a dramatic decrease in artifact frequency with increased depth and it is likely that most of the artifacts found at depths of more than 30 cm were translocated downward in the profile by root action, rodent burrowing, or other natural post-depositional processes. Consequently, Horizons II and III, with the occasional presence of pebbles, probably represent a silty low energy facies of the Columbia Formation.

FIGURE 15
Hell Island Cord-marked Ceramics--Area A
(ca. A.D. 600 - A.D. 1000)



It should be noted that the original test excavations recovered what seemed to be a large number of artifacts at depths of up to 40 cm (Table 1). The numbers of buried artifacts seemed to be high and indicated the presence of buried landscapes and associated archaeological deposits. However, after more extensive excavations, it was seen that the artifact densities from the site were very high (Table 4). Consequently, a small **proportion** of the artifacts could move through the profile and create a large absolute number of artifacts at depth in the profile. Nonetheless, the total vertical distribution data clearly show that the bulk of the artifacts from this area of the site are contained in the top 20-30 cm of the profile and other deeper artifacts are displaced and were not buried **in situ**.

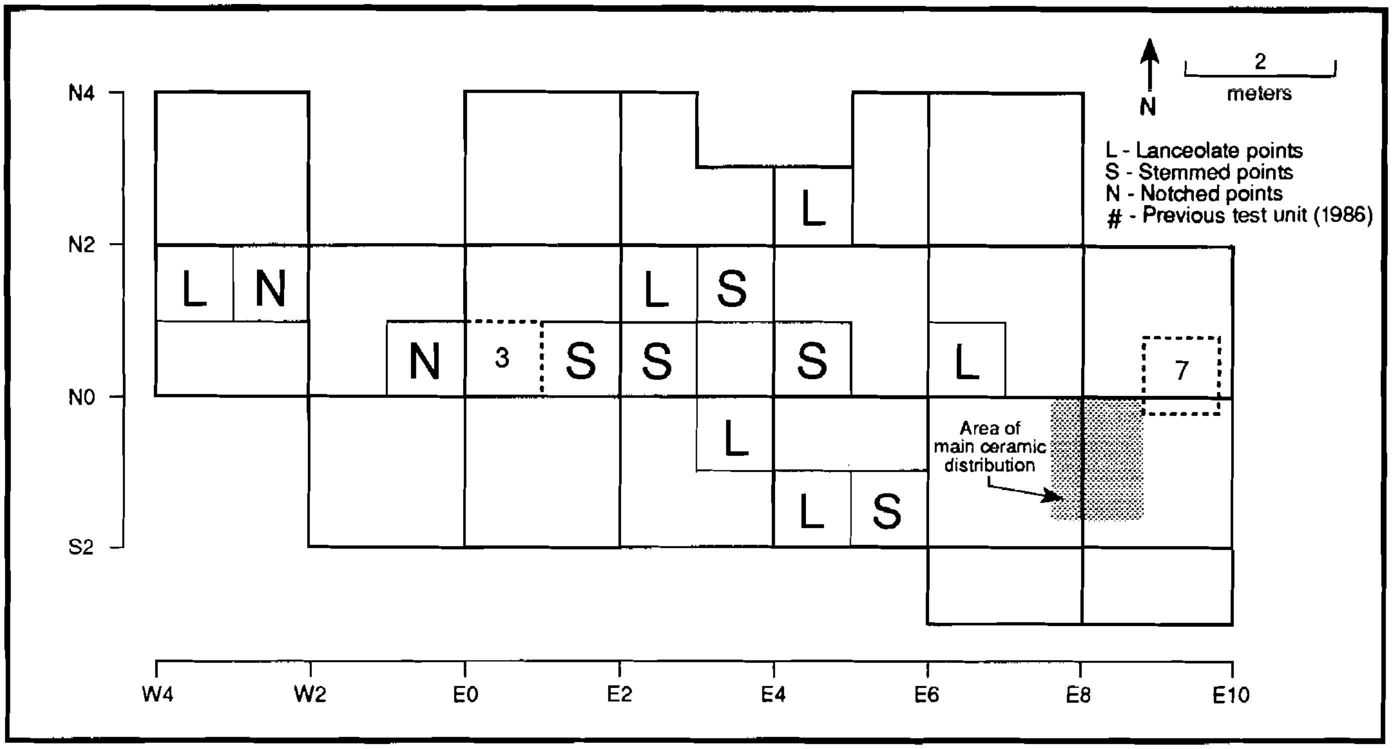
Because the artifacts are relatively shallow and buried in a compressed and thin stratigraphic context, and because the natural displacement of artifacts at this site seems to extend over at least 30 cm, it is impossible to distinguish separate components at the site and all of the artifacts must be viewed as a series of disturbed multicomponent occupations for analysis. In some ways, the site's context is similar to an excavated plow zone collection even though the profile of Area A shows no sign of plow disturbance.

Site Chronology

No radiocarbon samples were recovered from Area A; therefore, diagnostic projectile points and ceramic wares are the main sources of data for determining the chronology of this site area's occupation. Figure 15 shows a sample of the ceramic sherds found in Area A and all are examples of Hell Island cord-marked, grit-tempered wares (Custer 1989:175-176). In some cases (e.g., Figures 15A and 15C), there are deeply-impressed cordmarks in single directions, and in other cases (e.g., Figure 15B), the cordmarks cross one another at angles suggesting that the cordmarks were applied with a cord-wrapped paddle that was applied to the wet clay at a variety of angles. These kinds of cordmarking are typical of Hell Island ceramics. Most of the ceramic sherds from Area A also show interior cordmarking which is typical of Hell Island ceramics.

FIGURE 16

Distribution of Diagnostic Artifacts--Area A

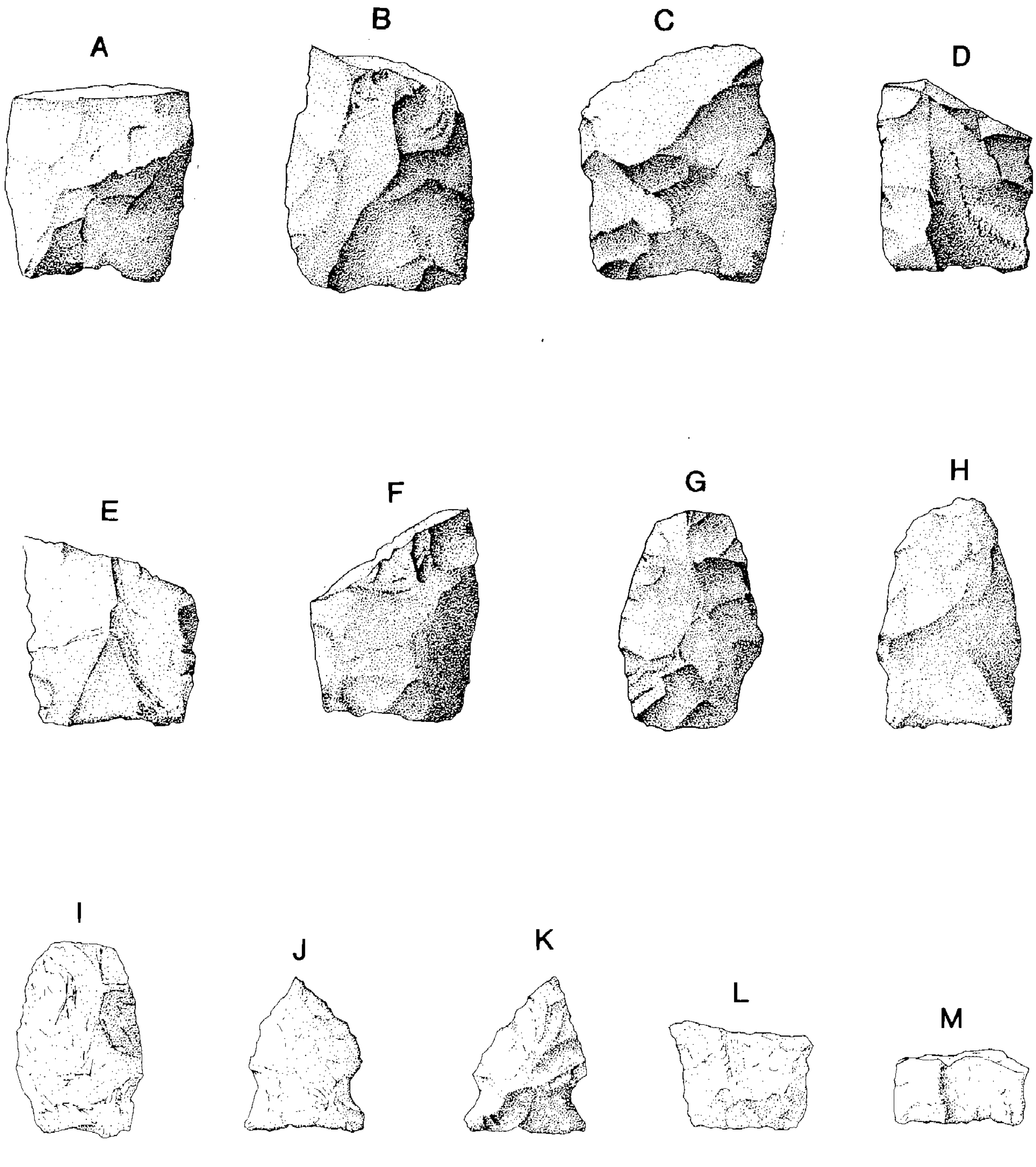


The date range for Hell Island ceramics is A.D. 600 - A.D. 1000 (Custer 1989:176) and this date range applies to at least a portion of Area A. Figure 16 shows the distribution of the Hell Island ceramics within Area A and it can be seen that they are found in a very limited area of the site. Therefore, the most that can be said, based on the ceramics, is that a small section of Area A was occupied between A.D. 600 - A.D. 1000.

Figure 17 shows the diagnostic projectile points from Area A and three basic types are present: lanceolate, notched, and stemmed. Lanceolate forms (Figure 17A - F) can be characterized as Fox Creek, or perhaps Jacks Reef pentagonal types. Both types are coeval and probably date to the A.D. 400 - A.D. 900 time period (Custer 1989:156-160). Stemmed and notched points (Figure 17G-M) are also present in the collection and are not really diagnostic of any particular time period. The co-occurrence of these point types and the Jacks Reef/Fox Creek forms is not unexpected; however, it is possible that the stemmed and notched points could represent an earlier occupation of the site. Figure 16 shows that the projectile points are distributed more widely across the site than the ceramics and are found throughout the central section of the site. Thus, the A.D. 400 - A.D. 900 time range applies to a larger section of the site than was seen from the distribution of the ceramics alone. The bulk of the artifacts are found in the central section of the site; therefore, most of the site probably primarily represents one or more Delaware Park Complex occupations (Custer 1984:82-85) that occurred between the dates of A.D. 400 and A.D. 900.

FIGURE 17

Projectile Points--Area A



A - N2 E4, Level 1, SW (jasper)
B - S2 E2, Level 1, NE (jasper)
C - S2 E4, Level 1,SW (jasper)
D - N0 E6, Level 2 (jasper)
E - N0 E2, Level 7 (jasper)
F - N0 W4, Level 3 (jasper)
G - S2 E4, Level 1, SE (jasper)
H - N0 E4, Level 3 (jasper)
I - N0 E0, Level 1, SE (quartz)
J - N0 W2, Level 4 (quartz)
K - N0 W4, Level 3 (jasper)
L - N0 E2, Level 1, NE (quartz)
M - N0 E2, Level 2 (quartz)

1 cm

Chipped Stone Tool Technology

The lithic technologies represented at Area A will be analyzed by considering each of the major categories of lithic artifact types found at the site.

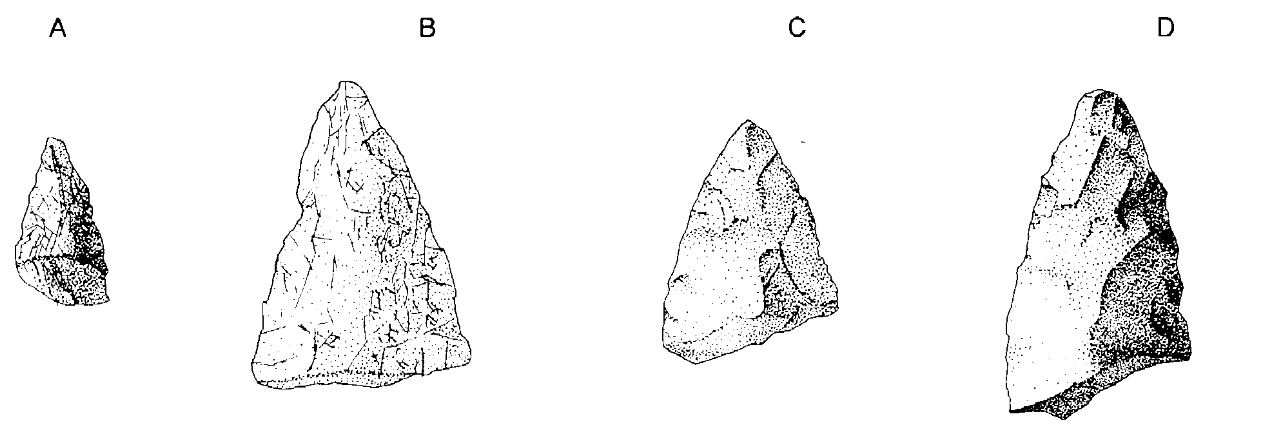
Projectile Points. Figure 17 shows a sample of the projectile points, not including tip fragments, from Area A. Six of the projectile points (Figure 17A-F) depicted are made from jasper and are lanceolate forms with transverse fractures across their midsections. All six have relatively thick cross-sections and have irregularly shaped protrusions, or humps, surrounded by step and hinge fractures on one or both faces. The humps occur when attempts to finish the secondary thinning of the points fail. Transverse fractures occur when the flintknapper tries to remove the hump, usually with an end-thinning blow, and strikes the unfinished tool too hard. The force of the blow snaps the point rather than removing the flake (Callahan 1979:104). Therefore, the six lanceolate jasper points were probably broken in manufacture at the site.

The remaining seven points illustrated in Figure 17 (G - M) are stemmed and notched forms manufactured from jasper and quartz. Three of the points (Figure 17G - I) show tip damage indicative of use as projectile points (Ahler 1971). Two notched points (Figure 17J - K) are heavily resharpened. It is most likely that these points were used and reused as projectile points or knives, periodically resharpened, and ultimately discarded due to their exhausted condition. The remaining two specimens (Figure 17L - M) are basal fragments that have snapped off just at the limit of the basal stem hafting element. Stem breaks are typical of points that were broken while hafted. In some cases stem breaks are produced during projectile point use when the hafting element is loose and the projectile "wiggles" upon impact. The shear stress of the "wiggle" snaps off the point base at the limit of the haft.

A series of projectile point tips were also found in Area A, and a sample of them is illustrated in Figure 18. Jasper, chert, and quartz point tip fragments are present in the collection and show a variety of breakage patterns. Impact fractures (e.g., Figure 18A) are seen on quartz, jasper, and chert tip

FIGURE 18

Projectile Point Tips--Area A

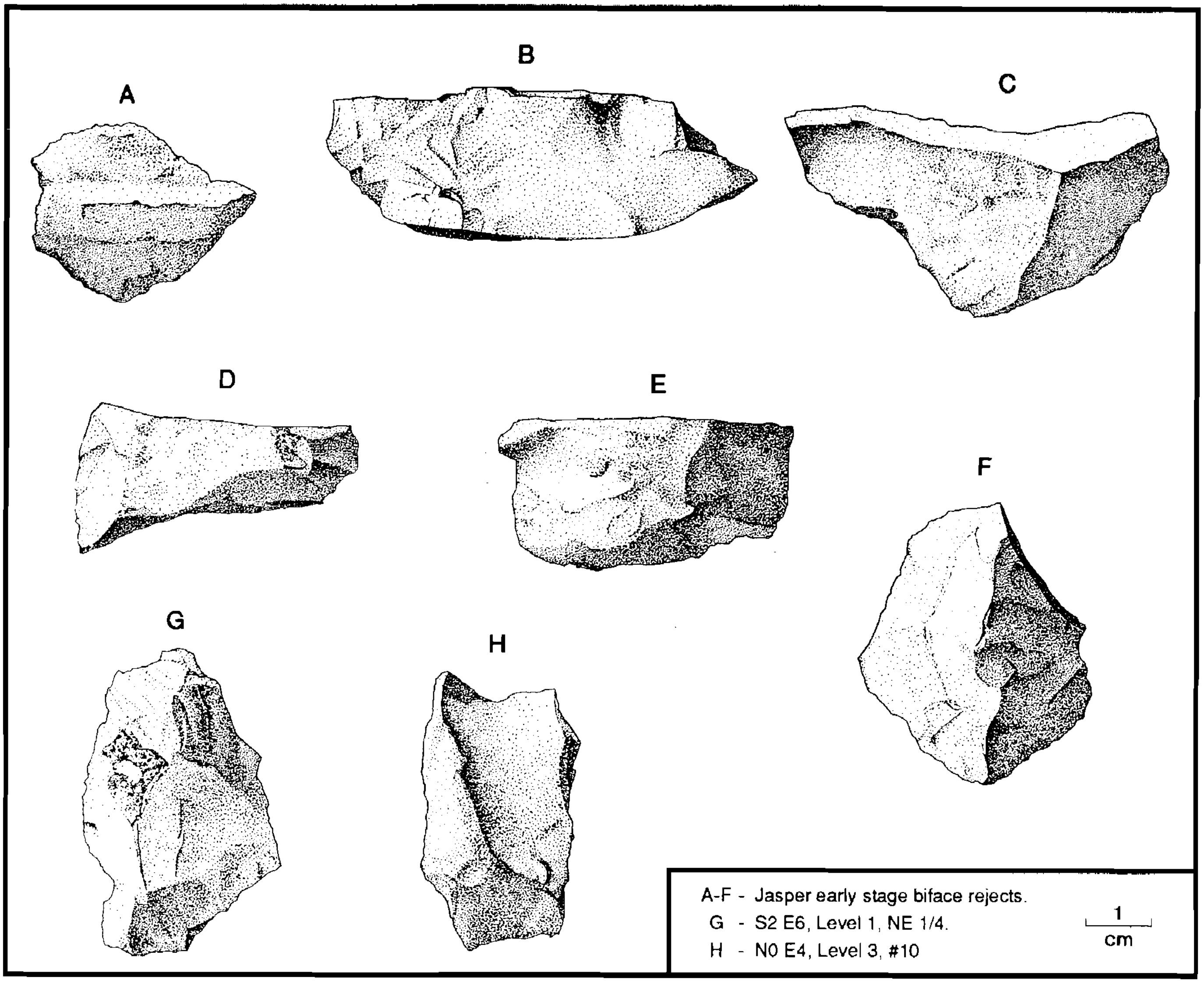


A - N0 E4, Level 6, #2 (quartz)
B - S4 E8, Level 1, NE (quartz)
C - N0 E4, Level 8, #3 (jasper)
D - N0 E6, Level 1, NW (jasper)

1 inch
2 cm

FIGURE 19

Sample of Early Stage Bifaces--Area A

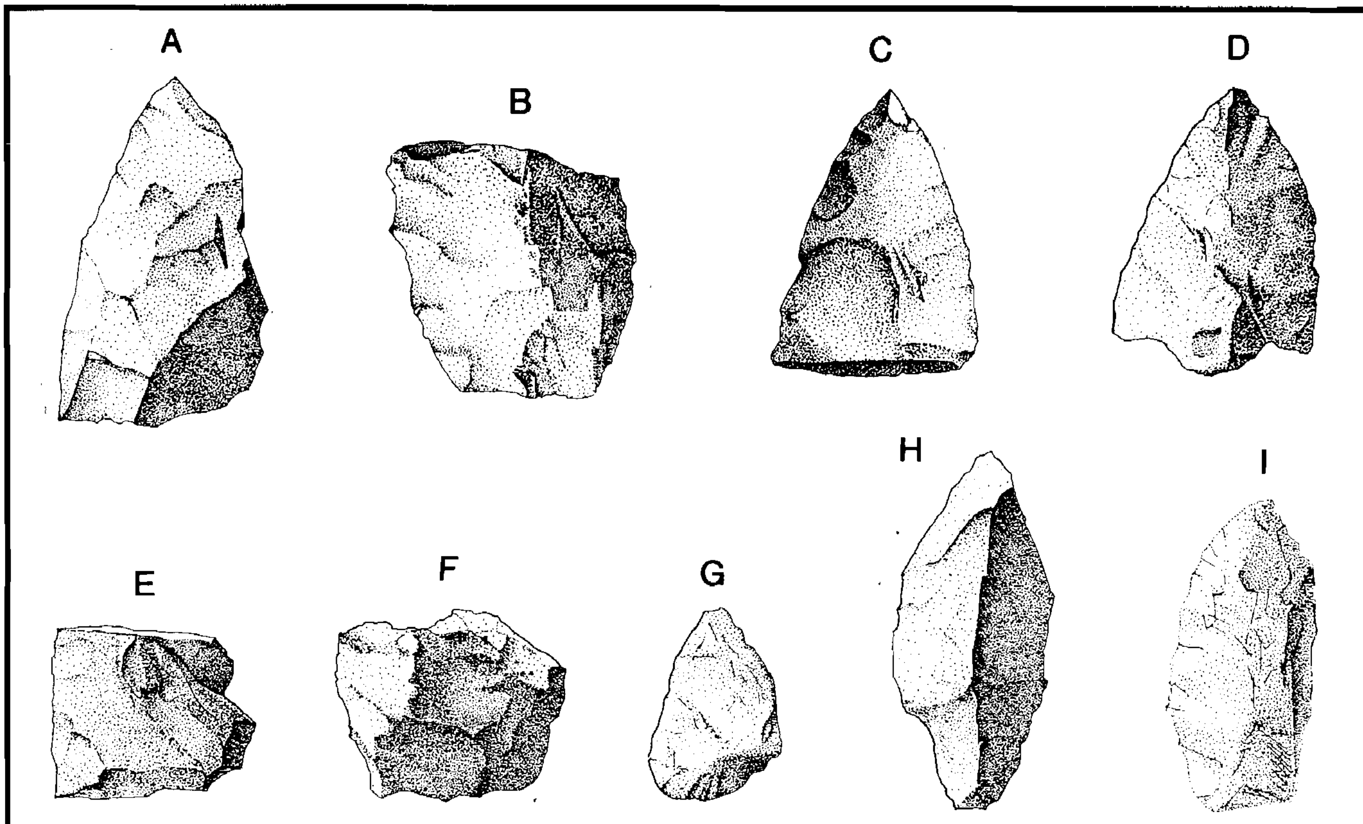


A-F - Jasper early stage biface rejects.
G - S2 E6, Level 1, NE 1/4.
H - N0 E4, Level 3, #10

fragments. In some cases (e.g., Figure 18B-D), impact fractures are present along with evidence of transverse medial fractures that are typical of cutting or prying motions. Transverse fractures are different from those noted above for unfinished projectile points because the transverse fractures shown in Figure 18 are **not** associated with step fractures and humps or other signs of manufacturing errors. Furthermore, the presence of impact fractures on these points' tips clearly shows that these artifacts were finished tools which had been used as both projectile points and knives.

In sum, the projectile point assemblage from Area A shows that a variety of broken projectile points, which had been used both as projectile points and knives, were discarded at Area A. The broken and discarded points were made from a variety of raw materials. In contrast, a series of jasper projectile points were also being manufactured at the site and some were broken and rejected during the final stages of their production.

FIGURE 20
Sample of Late Stage Bifaces--Area A



A - S2 E8, Level 2, East 1/2 (jasper)
B - N2 E0, Level 2, #1 (jasper)
C - N0 W2, Level 2, #3 (jasper)
D - Jasper late stage biface discard
E - N0 E4, Level 1, NW 1/4 (jasper)
F - N0 E4, Level 1, NE 1/4 (jasper)
G - Quartz late stage biface reworked into scraping tool
H - N0 E0, Level 5, # 2 (jasper)
I - S2 E4, Level 3, # 9 (quartz)

1 cm

Bifaces. Figures 19 and 20 shows a sample of the bifaces recovered from Area A, and Table 6 shows a summary cross-tabulation of the biface and point manufacturing stages and raw materials. The assemblage includes bifaces in various stages of manufacture and various conditions of damage. Twenty-five percent of the bifaces are in the early stages of manufacture. The overwhelming majority of these bifaces (74%) are made of jasper. Nearly one-third (31%) of the early stage bifaces contain remnant cortex (Figure 19C, D, F), indicating that local cobbles were being used to manufacture some tools at the site.

Many of the early stage bifaces are quite thick and have fractures across their mid-sections (Figure 19A-E). Manufacturing errors of this type occur most often in the course of end-thinning even though the snap occurs across the mid-section (Callahan 1979:109). Some of the rejects appear to have been caused by inclusions or imperfections in the material (Figure 19A), and one lateral break occurred (Figure 19F) from either lateral thinning or from attempts to thin and remove cortex from the medial ridge of the biface. The chalcedony biface (Figure 19G) contains crystal inclusions which may have been the cause of its rejection. Lastly, one of the biface rejects (Figure 19C) broken in manufacture shows signs of utilization along a small section of its edge.

TABLE 6

Cross-tabulation of Biface/Point Types and Raw Materials - Area A

Tool class	Quartzite	Quartz	Chert	Jasper	Chalcedony	Total
Rejects	0	1	0	27(3)	1(1)	29(4)
Discards	1	10	1	12	0	24
Total	**1**	**11**	1	**39(3)**	**1(1)**	**53(4)**
Early stage biface	0	0	0	12(3)	1(1)	13(4)
Late stage biface	1	7	1	18	0	27
Points	0	4	0	9	0	13
Total	**1**	**11**	**1**	**39(3)**	**1(1)**	**53(4)**

KEY: ( ) = cortex

Bifaces in the later stages of manufacture dominate the biface assemblage from Area A (51%; Table 6). The vast majority of these bifaces are made of cryptocrystalline materials; the remainder are made of quartz and quartzite. None of these bifaces shows signs of cortex, which suggests either that primary materials were preferred or that cortex had been removed elsewhere. In general, these materials do not appear to be of high quality. Some bifaces appear to have split along internal fracture planes (Figure 20E), while others appear to have broken because of the presence of iron encrustations that left them weak and brittle (Figure 20F).

Additional damage patterns observed on bifaces include manufacturing errors that occurred during the later stages of thinning such as step and hinge fractures surrounding humps in a biface's mid-section or along its lateral edge (Callahan 1979:145-153). Failure in thinning attempts often results in fractures across the middle of the biface (Figure 20B). Other bifaces showed lateral breaks from later stage thinning (Figure 20H and I).

In addition to manufacturing errors, many of the late stage bifaces show signs of damage from use. Several of these late stage bifaces (such as Figure 20C) have transverse medial fractures that are not associated with step and hinge fractures, humps, or other attributes that would suggest manufacturing flaws. Ahler (1971) has observed that such fractures occur as a result of twisting and prying motions associated with butchering activities. One of the late stage bifaces (Figure 20D) was snap-fractured just above the base where it appears to have separated from the base while hafted. The single quartz late stage biface (Figure 20G) was broken at the shoulder and then reworked into a scraping tool. The remaining discarded late stage bifaces are all distal sections with impact fractures similar to those previously discussed and illustrated in Figure 18.

The total number of rejects (29) and discards (24) is fairly evenly divided (Table 6). However, in terms of material type, there are considerably more used and discarded quartz bifaces than those rejected in manufacture. The data also indicates that all of the quartz bifaces were in the later stages of manufacture. Therefore, it appears that broken and exhausted quartz points and bifaces were being culled from the curated tool kits, and were being replaced by bifaces made of jasper.

PLATE 7

Sample of Cores--Area A

Click Here to View Photo

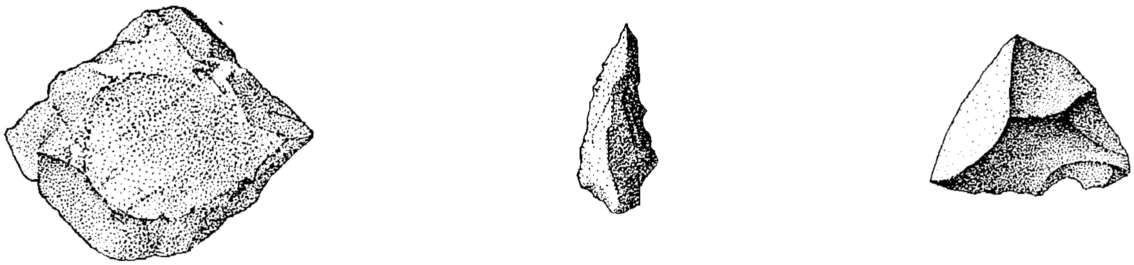
Table 6 also shows that the total number of late stage bifaces is more than twice that of early stage bifaces. However, in terms of material type, there are more than twice as many rejected jasper bifaces as discarded jasper bifaces. These bifaces were rejected largely in the later stages of manufacture or in nearly finished form.

In sum, the biface assemblage from Area A has more late stage than early stage bifaces and about an equal amount of rejects and discards. Jasper is the dominant material among the bifaces followed by a small amount of quartz. The majority of quartz bifaces are exhausted late stage discards that appear to have been culled from curated tool kits. Rejected cryptocrystalline bifaces exhibited instances of material flaws that may have contributed to their rejection. Discarded bifaces mainly exhibited damage from twisting/prying motions and impact. A minority of the bifaces had remnant cortex indicating that at least some local cobbles were being used to make replacement tools, although primary materials were preferred.

Cores. Plate 7 shows a sample of the cores from Area A. In general, the cores are small (3 cm maximum dimension) to medium (6.5 cm maximum dimension) in size and chunky or blocky in form. Some show that they were sources of long blade-like flakes (Plate 7A and B); others show the removal of wider flakes (Plate 7C). Seventy-five percent of the cores were made of jasper; the remainder were made of quartz. Thirty-one percent had remnant cortex, indicating that at least some local cobbles were used for the production of flakes. A few of the cores (Plate 7C) had sufficient material remaining to produce more flakes, but the majority were either very small and exhausted, or had cortex or crystal inclusions that reduced the amount of good quality material available.

Flake Tools. Two unifacial tools (Figure 21-A and 21-B) were recovered in Area A. The first tool, an end scraper made on a thick quartz flake, has cortex on its dorsal surface. It appears to have been expediently manufactured from a locally available cobble. The second tool is a very small, roughly triangular shaped, chert tool with a sharply-pointed distal tip. One excurvate edge is retouched and forms a steep angle; the other incurvate edge appears to have been utilized. The faceted tip appears to be polished. A small patch of cortex is present near the proximal end, indicating that this tool was also made from a locally available cobble. However, the tool appears to have had multiple functions and may have been used in scraping and perforating activities. One other tool (Figure 21C) was recovered in Area A but its function is not known. It is a small, thick bifacially worked jasper fragment with a notched area along one edge near the distal end. Seven unretouched utilized flakes were also recovered in Area A.

FIGURE 21
Flake Tools--Area A



A - Quartz unifacial tool (S4 E8, Level 1)
B - Chert unifacial tool (N0 W4, Level 6)
C - Jasper miscellaneous stone tool (S2 E4, Level 1)

TABLE 7
Debitage Cortex and Raw Material - Area A

Cortex presence/ absence	Jasper	Quartz	Quartzite	Chert	Chalcedony
Absent	10,185	196	17	21	2
(% of raw material)	(100)	(92)	(81)	(81)	(100)
Present	40	17	4	5	0
(% of raw material)	(<1)	(8)	(19)	(19)	(0)
Total	10,225	213	21	26	2
(% of total raw material)	(98)	(2)	(<1)	(<1)	(<1)

Debitage. Table 7 shows the distribution of various types of raw materials and the presence of cortex on the debitage from Area A. The table shows a very low incidence of cortex on jasper and quartz debitage and a moderate presence of cortex on quartzite and chert debitage. However, it should be noted that the total number of quartzite and chert flakes is quite low. In short, the cortex percentages indicate that local cobbles did not play a strategic role in supplying material for the lithic needs of Area A's inhabitants, although cobbles appear to have been used to supplement preferred primary materials.

Table 7 also shows that jasper was by far the material of choice at Area A, comprising 98% of the total debitage assemblage. The site's proximity to the Delaware Chalcedony Complex quarries at Iron Hill (approximately 7 km) may explain the abundance of Chalcedony Complex materials in Area A.

A flake attribute analysis (Appendix II) was conducted on a sample of 100 randomly selected flakes from Area A in an attempt to determine whether the flakes resulted from the reduction of bifaces or from cores. The results of the analyses are shown in Table 8, and indicate an emphasis on biface reduction in Area A.

TABLE 8

Debitage Attribute Frequencies - Area A

Flake type		**Size**		**Platform shape**		**Platform preparation**	
Complete	43	< 2 cm	60	Triangular	25	Present	13
Proximal	28	2-5 cm	40	Flat	7	Absent	60
Medial	14	> 5 cm	0	Round	41	No observation	27
Distal	15			No observation	27		
		Scar count				**Directions count**	
Cortex		Mean	= 2.14	**Remnant Biface Edge**		Mean	= 1.83
Present	16	Standard deviation	= 1.35	Present	1	Standard deviation	= 1.05
Absent	84			Absent	99		

Sample of 100 flakes

For example, the relatively high incidence of broken flakes indicates that bifaces were being reduced in Area A (Lowery and Custer 1990:97). Another indication of biface reduction is the relatively high incidence of triangular and round striking platforms. Gunn and Mahula (1977) have noted an association of triangular platforms with biface thinning flakes and of round platforms with early stage biface reduction flakes. Two other attributes associated with biface reduction are platform preparation and the presence of remnant biface edges (Lowery and Custer 1990:98); a low incidence of preparation was present on the flake sample, but only one flake contained a remnant biface edge. The number of flake scars present on the dorsal surface of sample flakes as well as the number of directions in which the scars were oriented was also considered. The mean values were determined and compared to those produced by Errett Callahan for his analysis of debitage from the reduction of early and late stage bifaces and cores (Appendix II: Table 34). In terms of both the number of scars and the number of scar directions, the Area A sample is most similar to Callahan's late stage biface. This pattern is again consistent with data previously discussed. The relatively low incidence of cortex on the sample flakes indicates that primary raw materials were preferred for tool manufacture in Area A. The majority of flakes in the sample were quite small which is consistent with the late stage of manufacture of tools recovered from Area A. In general, the test sample from Area A indicates biface reduction.

In conclusion, debitage from Area A consists overwhelmingly of jasper flakes with a very low incidence of cortex. Furthermore, the flakes appear to have resulted primarily from the reduction of bifaces.

Blood Residue Analysis

Lithic artifacts from Area A were subjected to blood residue analysis using protocols developed by the University of Delaware Center for Archaeological Research (Custer, Ilgenfritz, and Doms 1988). The analysis is used to determine the presence of hemoglobin on the tools that could indicate use of the tools in game procurement and processing activities.

Soil, pebble, and gravel samples were taken from each subsoil level of each 2 m sq. test unit and tested as control samples to determine the presence of organic or chemical contamination. Table 9 shows the results of tests on soil samples and lithic tools. All of the 424 tests on 140 control samples produced negative results, indicating that the soils in Area A were free of contamination. Forty-three bifaces and flake tools were then tested. The test was applied to several loci on each tool for a total of 131 individual tests on 43 tools. All of the tools tested negative for the presence of blood residue.

TABLE 9

Summary of Blood Residue Analysis - Area A

Sample Type	Number of Samples	Number of tests conducted	Number of samples showing positive reaction	Number of samples showing negative reaction
Control (soils, pebbles, gravels)	140	424	0	140
Tools	43	131	0	43

In sum, the results indicate only that blood residues are not now present on these artifacts. No further interpretations are possible.

Floated Artifacts and Ecofacts

Flotation samples were taken from all units in Area A except Test Units N0E8 and S2E8. Excavation in these units was hindered by the presence of large tree roots and stumps in their eastern halves which were left unexcavated. For the remaining units, one 50 cm sq. block from each of the units was selected, and all soil from that block was bagged by 5 cm level and returned to the lab for processing. Therefore, each individual sample represents 12,500 cubic centimeters of soil. All samples were then processed using a water driven flotation tank to separate heavy and light fractions. Heavy fractions were collected in window mesh size screen, and light fractions were collected in a silk bag. After drying, all artifacts and ecofacts were removed and cataloged.

Table 10 summarizes the lithic flakes and charred plant remains obtained from flotation sampling. Because it is possible that uncharred plant remains are modern contaminants rather than well-preserved archaeological materials, these remains were excluded from analysis and only charred remains were considered. Artifacts recovered in the heavy fraction consist of lithic debitage. Charred organic remains from the light fraction consist largely of non-edible seeds and spores, with a small amount of charcoal also present.

As previously discussed, movement of artifacts through the profile has been demonstrated in Area A; therefore, the vertical position of artifacts from flotation will not be considered. Table 11 shows a comparison of raw material frequency between debitage recovered from 1/4-in. mesh screens and that recovered from flotation. In general, the results of the comparison indicate that the two samples are consistent with one another. Jasper overwhelmingly dominates the flotation sample as it does the 1/4-in. screen sample, and quartz follows with the next highest percentage in both samples. However, the screen sample shows a somewhat higher percentage of jasper flakes than the flotation sample which may suggest that the reduction of jasper bifaces and cores for the manufacture of new tools was a more important activity in Area A than was resharpening or reworking finished jasper tools which would have produced more micro-flakes. On the other hand, quartz was more prominent in the flotation sample than in the screen sample. The higher frequency of quartz debitage in the flotation sample is likely due to the fracturing characteristic of quartz which produces more micro fragments when broken than do lithic materials with a finer crystalline structure.

TABLE 10

Summary Catalog of Artifacts and Ecofacts Recovered in Flotation Sample - Area A

Lithic Debitage		Charred Remains			
Jasper	705(5)	Spores	924	Greenbriar (Smilax glauca)	1
Quartz	82	Nutshell	7	Smooth Sumac (Rhus glabra)	1
Chert	7	Unidentified seed	5	Bayberry (Myrica pennsylvanica)	1
Chalcedony	4	Unidentified fragments	2	Blackgum (Nyssa biflora)	1
Quartzite	1				

KEY: ( ) = cortex

TABLE 11

Raw Material Frequency: Flotation vs. 1/4-inch Screen - Area A

	Flotation			Screen	
Jasper	705(5)	88.20%	Jasper	10,294(46)	97.33%
Quartz	82	10.30%	Quartz	229(20)	2.17%
Chert	7	.90%	Chert	28 (6)	.28%
Quartzite	1	.10%	Quartzite	22 (4)	.21%
Chalcedony	4	.50%	Chalcedony	3	.03%

KEY: ( ) = cortex

In sum, the charred organic remains from Area A largely consist of spores and non-edible seeds and do not suggest processing of food resources. Lithic debitage from flotation is consistent with that recovered in 1/4-in. screens and indicates a preference for jasper materials in the manufacture of new tools, while some edge maintenance of finished jasper tools is also indicated. A small amount of quartz chipping activity is evident.

Ceramic and Textile Technologies

Seventy-six percent of the ceramic sherds recovered from Area A are identified as Hell Island type based on a temper of quartz and mica (Griffith 1982). The remaining sherds are too small to be reliably classified as particular diagnostic types. The overwhelming majority of Hell Island sherds are small and many are spalled. The largest intact sherd measures 6.63 cm at its maximum dimension, and sherds range from 0.8 cm to 1.3 cm in thickness.

Analysis of the surface treatments observed on the sherds from Area A provides some insight into ceramic and textile practices at the site. A variety of surface treatments is present, including corded (88%), fabric impressed (6%), and incised (5%). Only four sherds lack any trace of surface design. Of the 144 Hell Island sherds from Area A, only three (2%) are rim pieces and these are quite small (Plate 8-A and B). All of the rim sherds show cording, and one of the rims (Plate 8-A) also shows incising.

PLATE 8

Sample of Ceramic Sherds--Area A

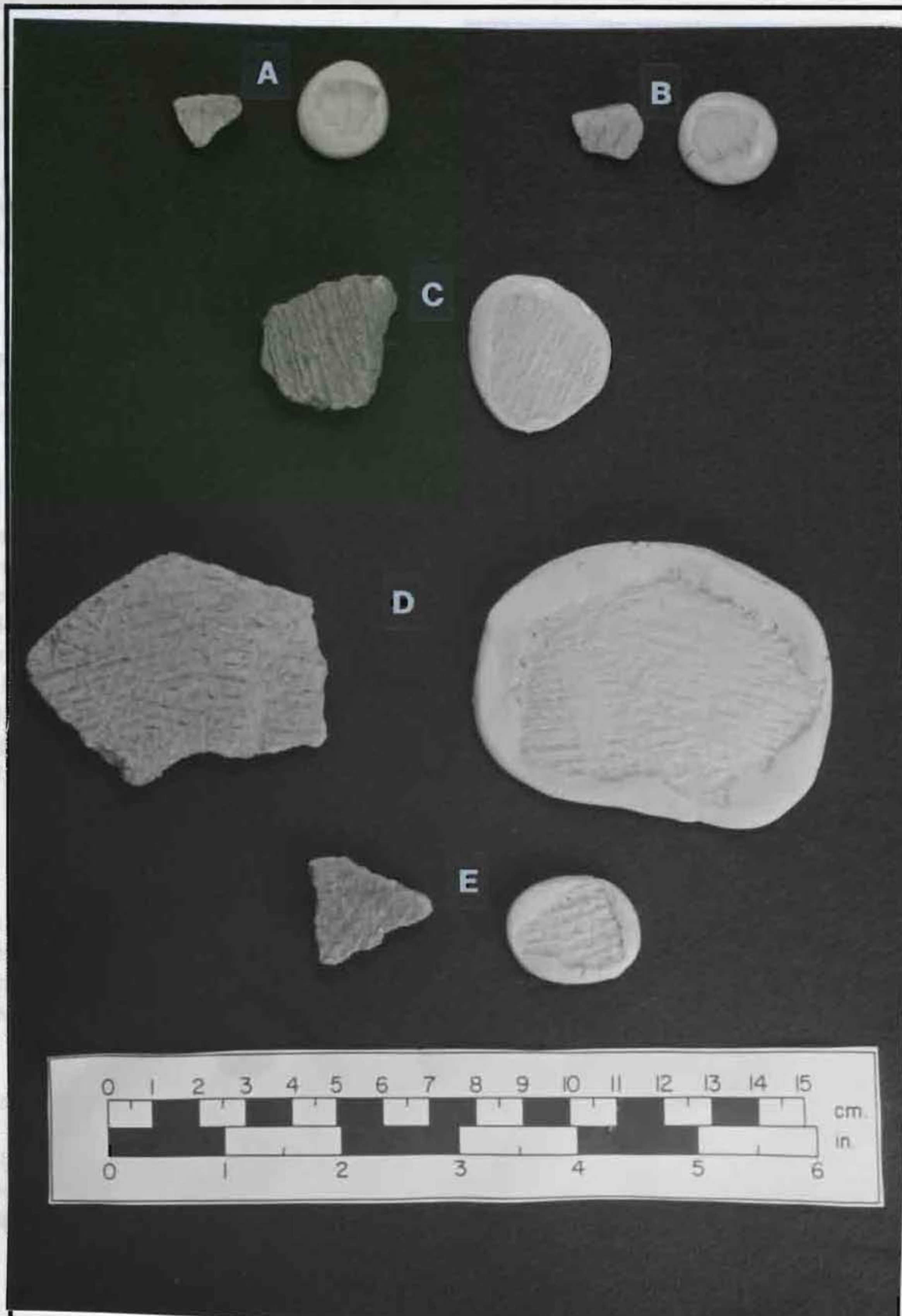
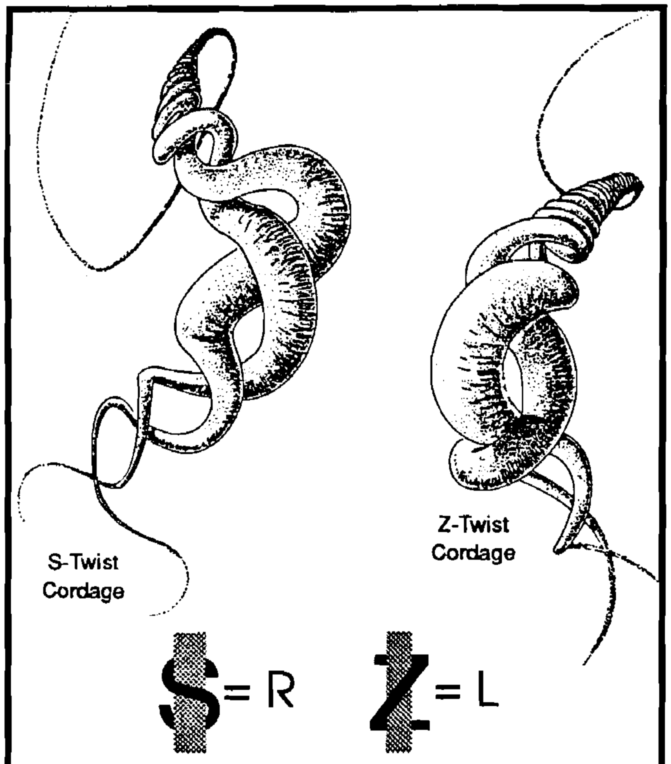


FIGURE 22

Varieties of Cordage Twists



Direction of twist, spin or weft slant and symbols employed in their description (after Hurley, 1979)

Corded surface treatments are by far the most common designs on ceramic sherds from Area A. Where these treatments are present, it is possible to make clay impressions of the ceramic sherds to study the cordages and textiles. Plate 8 shows the paired ceramics and clay impressions. The clay impressions show that cord-wrapped sticks and paddles were used to create the designs on the largest number of Hell Island sherds. Seventy-three (57%) of the corded sherds show that the designs were applied in multiple directions (Plate 8-D), whereas 54 (43%) show designs patterned in a single direction only (Plate 8-C). Although only nine sherds were found to contain fabric impressions (Plate 8-E), the frequency of the designs (3/cm - 41/cm) on these sherds indicates that the same fabric was applied more than once with various directions to its orientation.

Further examination of the clay impressions shows additional patterns of cordage manufacturing. Two basic patterns of cordage twist directions (S-twist and Z-twist) are present on ceramic wares in archaeological assemblages (Figure 22). Numerous studies (Petersen and Hamilton 1984; Adovasio 1983; Johnson 1991) have shown that the direction of cordage twists can be used to identify ethnic groups within regional spheres of social interaction. Virtually all of the discernible cordage twists in the Area A assemblage are Z-twists. Thus, it can be said that the Hell Island assemblage in Area A is dominated by Z-twist cordages as recorded from ceramic design impressions.

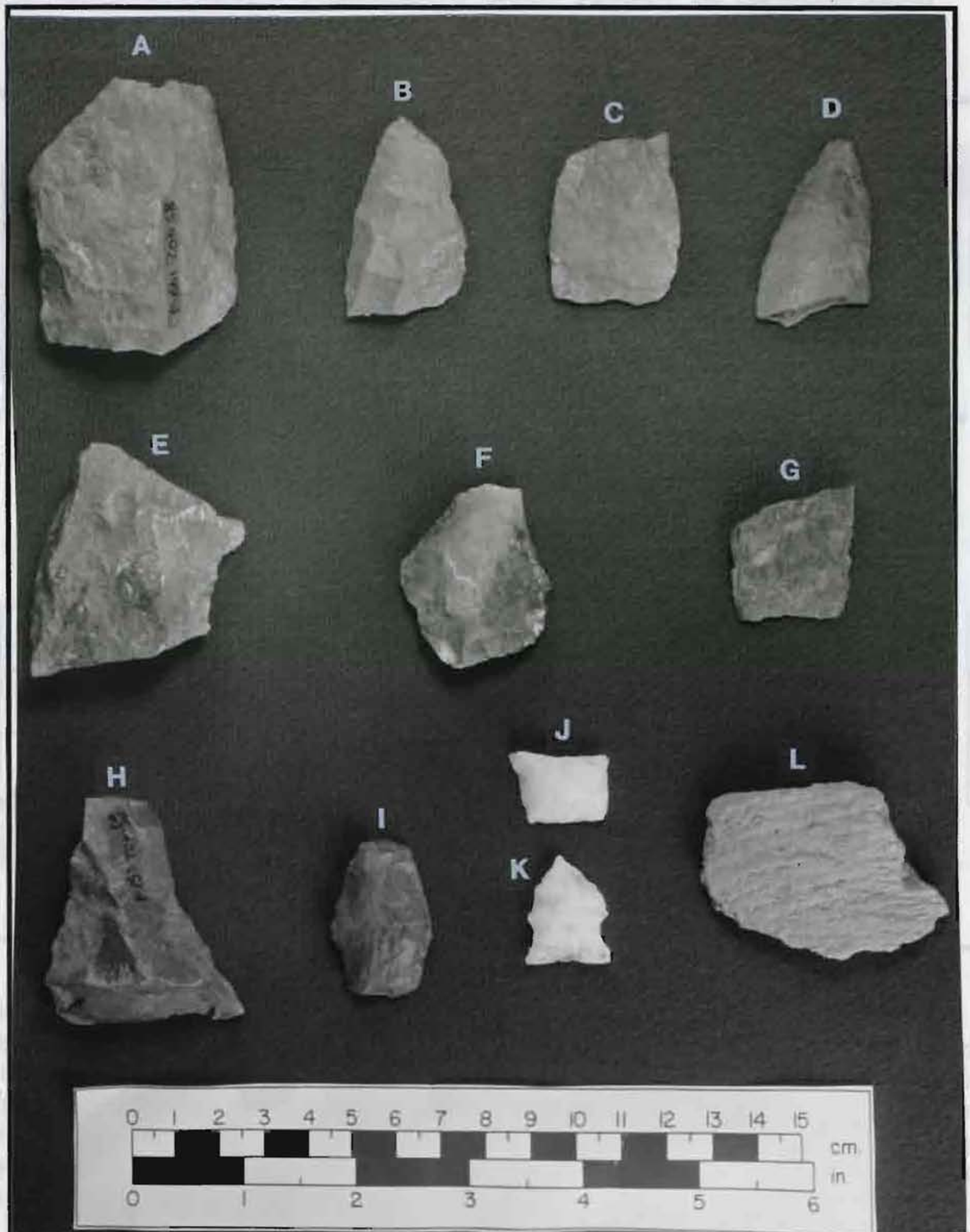
Activity Areas

In order to delineate any horizontal clustering, the spatial distributions of various artifact classes (tools, debitage, ceramic sherds, and fire-cracked rocks) were mapped using each 2 m sq. test unit as a minimum provenience unit within undisturbed soils. As mentioned in the section on site stratigraphy and chronology, the vertical position of artifacts is thought to be disturbed; therefore, artifacts from all levels have been combined together for the analysis of activity areas.

Figure 23 shows the location of all tools, debitage, ceramic sherds, and fire-cracked rocks recovered from Area A, and Plate 9 shows a sample of the artifacts recovered from the area. Tool concentrations are relatively dense throughout all of Area A, but are densest in the center around Test Units N0E2 and N0E4 and in the southeastern corner in Test Units S3E6 and S3E8. The center concentration consists primarily of projectile points and bifaces, whereas cores are dominant in the southeastern corner.

PLATE 9

Sample of Artifacts Recovered from Area A



A - Jasper core	G - Jasper lanceolate point base
B - Jasper late stage biface reject	H - Jasper core
C - Jasper lanceolate point base	I - Jasper stemmed point
D - Jasper point tip	J - Quartz point base
E - Jasper core	K - Quartz side-notched point
F - Jasper early stage biface reject	L - Hell Island cord-marked ceramic sherd

FIGURE 23

Distribution of Tools, Total Debitage, Ceramic Sherds, and Fire-Cracked Rocks--Area A

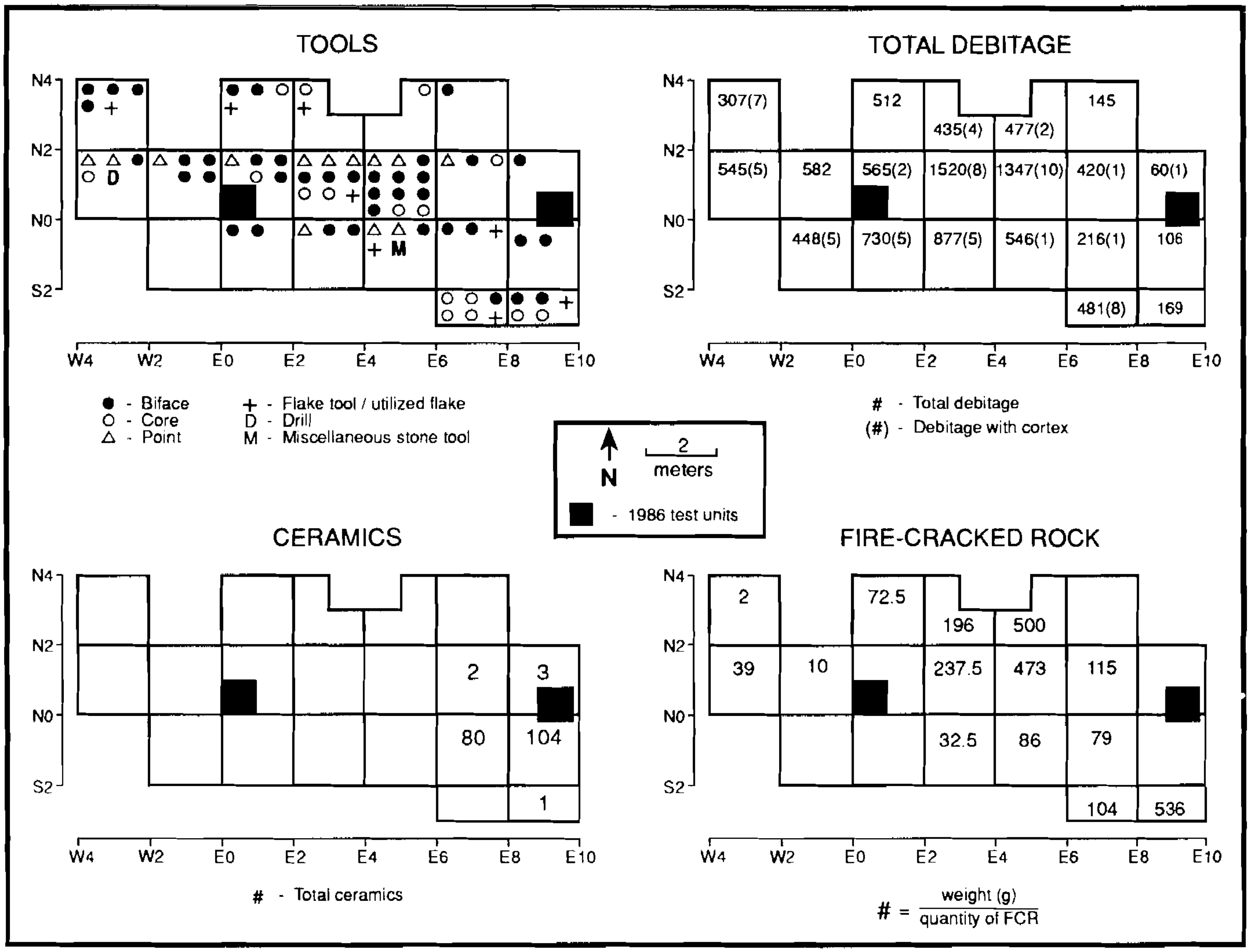
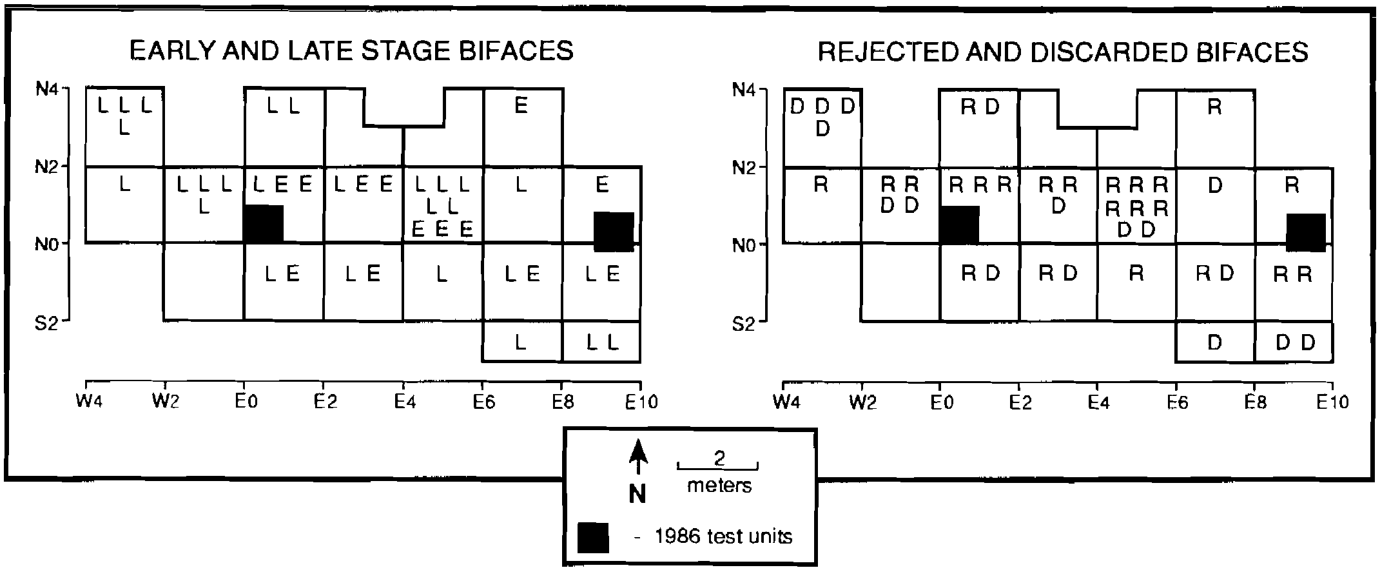


Figure 24 shows the location of early and late stage bifaces (Callahan 1979). This figure also shows the location of bifaces that were rejected in the course of manufacture and those that were used and discarded due to damage or extreme wear. All of these categories of bifaces are present throughout Area A; however, both early stage and rejected bifaces are generally clustered in the central area where high concentrations of debitage are also present (Figure 23 and 24). These distributions suggest that the manufacture of stone tools, particularly bifaces was an important activity in the central part of Area A. Late stage and discarded bifaces are more evenly distributed across Area A, except for a small concentration of late stage discarded bifaces in the northwest corner.

Figure 23 shows the distribution of debitage in Area A. As previously discussed, flakes are concentrated in the central core of the area where tool manufacturing is indicated. Figure 25 shows the distribution of flakes of various raw materials. Jasper makes up the majority of flakes in Area A and

FIGURE 24

Distribution of Early Stage and Late Stage Bifaces, and Rejected and Discarded Bifaces--Area A



corresponds to the distribution for total debitage (Figure 23). Quartz is present in much lower quantities than jasper but generally also conforms to the distribution for total debitage. Chert and quartzite are present in quantities too low to be considered meaningful. In sum, the quantity and distribution of debitage indicates tool manufacturing activities with a strong reliance on primary jasper materials throughout Area A and particularly in the central core.

Ceramic sherds in Area A are clustered mainly in two test units (S2E6 and S2E8) in the southeastern portion of the area (Figure 23). As previously discussed, all of the identifiable sherds in Area A are Hell Island. Although different surface treatments are indicated, it is possible that a variety of treatments would have been used on a single vessel. The fact that the sherds are clustered in a small area further suggests that they represent one, or possibly two vessels. The location of the majority of these sherds (Figure 23) is surrounded by areas where fire-cracked rock concentrations are present (Figure 23). This association might suggest food preparation, however, no signs of burning or sooting are present on any of the sherds and no food processing tools or charred edible seeds were located in this area of the site. Therefore, the function of the vessel or vessels and the activities associated with them cannot be ascertained.

Figure 23 shows the location of fire-cracked rocks in Area A. Several small concentrations are indicated throughout the area with the heaviest concentrations observed mainly in two areas: the north-central portion and the southeastern corner. These concentrations may represent hearth areas but they cannot be clearly associated with particular, separate activity areas.

In sum, no clearly defined separate activity areas can be delineated in Area A. However, concentrations of bifaces, cores, tools rejected in the course of manufacture, and waste flakes, all largely derived from primary jasper, indicate that Area A, in general, was the location of tool manufacturing activity. Concentrations of fire-cracked rocks and ceramic sherds suggest that the occupation may have lasted for a couple of days, but the absence of storage and habitation features and tools associated with food preparation suggests that the occupation was not sustained for any length of time.

In conclusion, the archaeological data suggests that Area A was occupied during the Woodland I Period (ca. 3000 B.C. - A.D. 1000), particularly the latter part after A.D. 0 and that the primary activity taking place in this area was the manufacture of bifacial tools from primary jasper. At the same time, broken and exhausted tools of both jasper and quartz were being culled from the curated tool kits.

FIGURE 25

Distribution of Jasper, Quartz, Chert, and Quartzite Flakes--Area A

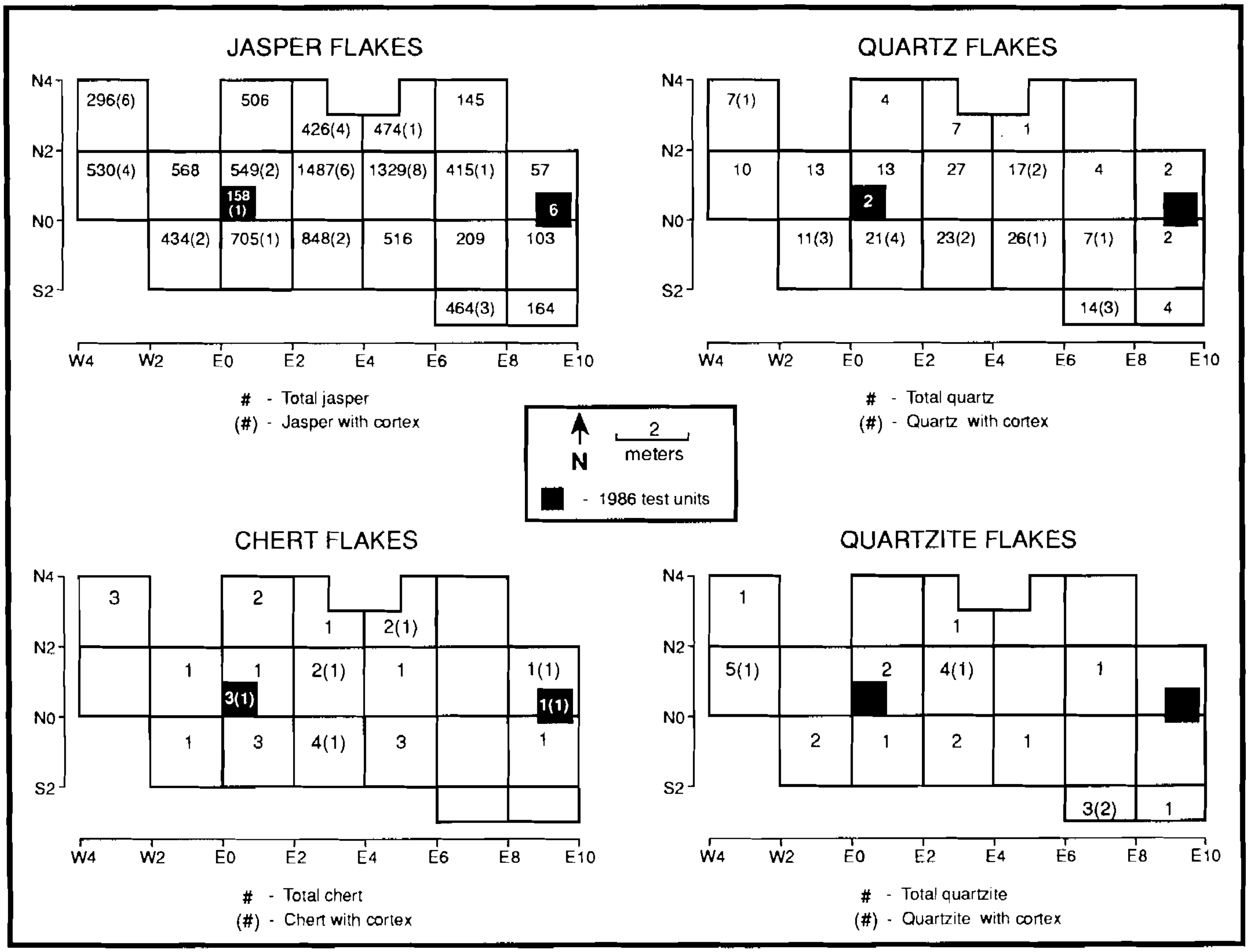


TABLE 12

Summary Catalog of Lithic Artifacts - Area B

	Jasper	Quartz	Quartzite	Chert	Chalcedony	Argillite	Ironstone	Rhyolite	Total
Flakes	1,688(15)	111(15)	28(7)	21(3)	44	1	4	0	1,897(40)
Cores	4	0	0	0	0	0	0	0	4
Utilized flakes	3	0	0	0	0	0	0	0	3
Flake tools	1	0	0	0	0	0	0	0	1
Early stage bifaces	6	3(1)	0	1	0	0	0	0	10(1)
Late stage bifaces	6	1	2	0	0	0	0	0	9
Projectile points	2	2	0	2	0	0	0	1	7
Total	**1,710(15)**	**117(16)**	**30(7)**	**24(3)**	**44**	**1**	**4**	**1**	**1,931(41)**

26 fire-cracked rocks

KEY: ( ) = cortex

PLATE 10

North Wall Profile--Area B

I - Dark brown-black sandy loam II - Yellow-brown sandy silt III - Orange-brown sandy silt with gravels